

WHAT IS CLAIMED IS:

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1. A protection method of protecting battery cells from over-discharging, comprising the steps of:

10 monitoring the voltage of each of the battery cells;

controlling a discharge control switch connected between a load and the battery cells in accordance with the voltage of each of the battery cells; and

15 maintaining the discharge control switch in a forced OFF state in accordance with a forced off signal supplied from outside.

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2. The protection method as claimed in claim 1, further comprising the step of releasing the discharge control switch from the forced OFF state in accordance with a release signal supplied from outside.

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3. The protection method as claimed in claim 1, wherein the discharge control switch is released from the forced OFF state when the battery cells are being charged.

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4. The protection method as claimed in claim 1, wherein the discharge control switch is released from the forced OFF state when any of the battery cells is in an overcharged state.

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5. The protection method as claimed in claim 1, wherein the discharge control switch is released from the forced OFF state when the voltage of any of the battery cells reaches a predetermined voltage value.

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6. A control circuit which is controlled in accordance with the voltage of each of battery cells by a monitor circuit monitoring over-discharge of the battery cells, and which controls a discharge control switch disposed between a load and the battery cells,

said control circuit comprising a forced OFF unit which forces the discharge control switch into a forced OFF state, regardless of a monitoring result of the monitor circuit.

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13. A control circuit which is controlled in accordance with the voltage of each of battery cells by a monitor circuit monitoring over-discharge of the battery cells, and which controls a discharge control switch disposed between a load and the battery cells,

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11. The control circuit as claimed in  
claim 7, wherein the discharge control switch is  
controlled by the monitor circuit when released from  
the forced OFF state by the release unit.

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15 12. The control circuit as claimed in  
claim 10, wherein the discharge control switch is  
controlled by the monitor circuit when released from  
the forced OFF state by the release unit.

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13. The control circuit as claimed in  
claim 6, further comprising:  
a detecting unit which detects whether the  
battery cells are in an overcharged state or not;  
and

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a release unit which releases the  
discharge control switch from the forced OFF state  
when any of the battery cells is in an overcharged  
state.

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13 14. The control circuit as claimed in  
claim 7, further comprising:  
a detecting unit which detects whether the  
battery cells are in an overcharged state or not;  
and

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a release unit which releases the  
discharge control switch from the forced OFF state  
when any of the battery cells is in an overcharged

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state.

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<sup>10.</sup>  
<sup>9</sup> ~~15.~~ The control circuit as claimed in  
claim ~~13~~, wherein the discharge control switch is  
controlled by the monitor circuit when released from  
the forced OFF state by the release unit.

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<sup>18</sup>  
<sup>17</sup> ~~16.~~ The control circuit as claimed in  
claim ~~14~~, wherein the discharge control switch is  
controlled by the monitor circuit when released from  
the forced OFF state by the release unit.

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<sup>11</sup>  
~~17.~~ The control circuit as claimed in  
claim 6, further comprising a release unit which  
releases the discharge control switch from the  
forced OFF state when the voltage of any of the  
battery cells reaches a predetermined voltage value.

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<sup>19.</sup>  
<sup>13</sup> ~~18.~~ The control circuit as claimed in  
claim ~~7~~, further comprising a release unit which  
releases the discharge control switch from the  
forced OFF state when the voltage of any of the  
battery cells reaches a predetermined voltage value.

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12.  
11 19. The control circuit as claimed in  
claim 17, wherein the predetermined voltage value  
can be set at a desired value.

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19 20. The control circuit as claimed in  
claim 18, wherein the predetermined voltage value  
10 can be set at a desired value.

15 21. A battery unit for supplying power to  
a load, comprising:

battery cells;

a monitor circuit which monitors an over-  
discharged state of the battery cells;

20 a discharge control switch which is  
controlled by the monitor circuit, and is disposed  
between the load and the battery cells; and

a forced OFF unit which forces the  
discharge control switch into a forced OFF state,  
25 regardless of a monitoring result of the monitor  
circuit.

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28.  
22. A battery unit for supplying power to  
a load, comprising:

battery cells;

35 a monitor circuit which monitors an over-  
discharged state of the battery cells;

a discharge control switch which is  
controlled by the monitor circuit, and is disposed

between the load and the battery cells; and  
a forced OFF state unit which forces the  
discharge control switch into a forced OFF state in  
accordance with a forced OFF signal supplied from  
5 outside the battery unit.

10 <sup>29.</sup>  
<sup>28</sup> 22. The battery unit as claimed in claim  
22, further comprising a release unit which releases  
the discharge control switch from the forced OFF  
state in accordance with a release signal supplied  
from outside the battery unit.

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<sup>22.</sup>  
24. The battery unit as claimed in claim  
20 21, further comprising:  
a detecting unit which detects whether the  
battery cells are being charged or not; and  
a release unit which releases the  
discharge control switch from the forced OFF state  
25 when the battery cells are being charged.

<sup>30</sup>  
30 <sup>28</sup> 25. The battery unit as claimed in claim  
22, further comprising:  
a detecting unit which detects whether the  
battery cells are being charged or not; and  
a release unit which releases the  
35 discharge control switch from the forced OFF state  
when the battery cells are being charged.

<sup>23</sup>  
~~22~~ <sup>26</sup> The battery unit as claimed in claim  
~~24~~, wherein the discharge control unit is controlled  
by the monitor circuit when released from the forced  
OFF state by the release unit.

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<sup>31</sup>  
<sup>30</sup> ~~25~~ <sup>27</sup> The battery unit as claimed in claim  
10 ~~25~~, wherein the discharge control unit is controlled  
by the monitor circuit when released from the forced  
OFF state by the release unit.

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<sup>24</sup>  
~~28~~ The battery unit as claimed in claim  
21, further comprising:  
a detecting unit which detects whether the  
20 battery cells are in an over-discharged state when  
the discharge control switch is held in the forced  
OFF state by the forced OFF unit; and  
a release unit which releases the  
discharge control switch from the forced OFF state  
25 when the battery cells are in an overcharged state.

<sup>32</sup>  
30 ~~28~~ <sup>29</sup> The battery unit as claimed in claim  
~~22~~, further comprising:  
a detecting unit which detects whether the  
battery cells are in an overcharged state when the  
discharge control switch is held in the forced OFF  
35 state by the forced OFF unit; and  
a release unit which releases the  
discharge control switch from the forced OFF state



when the battery cells are in an overcharged state.

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<sup>25.</sup>  
~~24.~~<sup>25.</sup> The battery unit as claimed in claim  
~~28.~~ wherein the discharge control switch is  
controlled by the monitor circuit when released from  
the forced OFF state by the release unit.

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<sup>33.</sup>  
<sup>32.</sup>~~29.~~ The battery unit as claimed in claim  
15 ~~29.~~ wherein the discharge control switch is  
controlled by the monitor circuit when released from  
the forced OFF state by the release unit.

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<sup>26.</sup>  
<sup>32.</sup>~~22.~~ The battery unit as claimed in claim  
21, further comprising a release unit which releases  
the discharge control switch from the forced OFF  
25 state when the voltage of any of the battery cells  
reaches a predetermined voltage value.

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<sup>34.</sup>  
<sup>28.</sup>~~22.~~ The battery unit as claimed in claim  
22, further comprising a release unit which releases  
the discharge control switch from the forced OFF  
state when the voltage of any of the battery cells  
35 reaches a predetermined voltage value.

<sup>27</sup>  
~~26~~ ~~34~~ The battery unit as claimed in claim  
~~32~~, wherein the predetermined voltage value can be  
set at a desired value.

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<sup>34</sup>  
~~35~~ 35. The battery unit as claimed in claim  
~~35~~, wherein the predetermined voltage value can be  
10 set at a desired value.

15 36. A control circuit in a protection  
circuit for a device having a discharge control  
switch which controls discharge and is situated  
between a load and battery cells supplying power to  
the load,

20 said control circuit comprising:  
a monitor circuit which judges whether any  
of the battery cells is in an over-discharged state  
or not from voltages inputted from the battery cells,  
and which switches off the discharge control switch  
25 when any of the battery cells is in an over-  
discharged state; and

a forced OFF unit which forces the  
discharge control switch into a forced OFF state in  
accordance with a signal supplied from outside.

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